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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/517,314	03/02/2000	Chih-Chen .Cho	M4065.0223/P223	5039

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EXAMINER
KANG, DONGHEE

ART UNIT	PAPER NUMBER
2811	

DATE MAILED: 04/30/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/517,314	CHO, CHIH-CHEN	
	Examiner	Art Unit	
	Donghee Kang	2811	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *11 April 2002* .

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,3-18,20-32 and 39* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1, 3-18, 20-32, and 39* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Remarks

1. The Declaration filed on April 11, 2002 under 37 CFR 1.131 is sufficient to overcome the Park (US 6,303,486) reference. The examiner withdraws his previously final rejection, and the following new final rejection is set forth.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims **1, 3-4, 9-10, 18, & 22-24** are rejected under 35 U.S.C. 103(a) as being unpatentable over Fig.11 of Chiang et al (US 5,739,579) in view of Fig.9 of Chiang et al (US 5,739,579).

Chiang discloses a semiconductor structure comprising (Fig.11):

an insulator layer (22); a conductive plug (100) positioned within said insulator layer and formed of a single conductive material; a doped region (21) connected to said conductive plug (100); an etch-stop layer (23) located on said insulator layer and surrounding said plug, wherein said etch-stop layer comprises silicon nitride or silicon carbide; a non-conductive layer (101) having an etched via at least partially over said conductive plug; and a conductive connector (102) formed in said via in electrical contact with said plug. Chiang does not teach the conductive connector includes a first conductor layer and a second conductor layer. However, Chiang teaches in alternate

embodiment Fig.9 the conductive connector includes a first conductor layer (60), which is made of TiN and a second conductor layer (61) made by copper. It is well known in the art and conventional to use copper with a barrier layer as a conductive interconnection layer instead of aluminum because copper has a lower resistivity than aluminum so as providing a higher speed. Thus it would have been obvious in the art at the time the invention was made to substitute aluminum of Chiang's device (Fig.11) with well-known copper/barrier layer taught by Chiang (Fig.9) since copper provides higher speed than aluminum and higher density in ICs. See Col.8, lines 55-67, Col.11, lines 12-48, & Col.14, line 65 – Col.15, line 3.

4. Claims **5-6** are rejected under 35 U.S.C. 103(a) as being unpatentable over Chiang et al (US 5,739,579) and further in view of Wang et al (US 6,184,128).

Regarding claim **5**, Chiang et al discloses the entire claimed invention, as applied to claim 1 above, except for non-conductive layer (etch-stop layer) comprising a silicon dioxide. Wang et al teach in Fig.7 the silicon dioxide layer acts as an etch-stop layer (Col.5, lines 49-64).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to substitute the silicon nitride of Chiang's device with a well known silicon dioxide as taught by Wang et al in order to provide the etch stop layer in the device. Furthermore, one of ordinary skill in the art would have recognized that the silicon nitride and silicon dioxide are both considered to be an art recognized functional equivalent for serving as an etch-stop layer for BPSG dielectric layer.

Regarding claim **6**, Chiang et al discloses the entire claimed invention, as applied to claim 1 above, except for non-conductive layer (etch-stop layer) comprising silicon nitride and silicon carbide. However, Wang et al teach in Fig.7 etch stop layer (13) includes the silicon nitride and silicon carbide layer (Col.5, lines 49-64).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to substitute the silicon nitride of Chiang's device with silicon nitride and silicon carbide layers as taught by Wang et al in order to provide the etch stop layer in the device. Furthermore, one of ordinary skill in the art would have recognized that the silicon nitride and silicon dioxide are both considered to be an art recognized functional equivalent for serving as an etch-stop layer for BPSG dielectric layer.

Moreover, it would have been obvious to one having ordinary skill in the art at the time the invention was made to form the etch-stop layer, *having the materials as claimed*, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416.

5. Claims **7-8 & 20-21** are rejected under 35 U.S.C. 103(a) as being unpatentable over Chiang et al (US 5,739,579) and further in view of Hong et al (US 6,008,117).

Chiang et al disclose substantially the entire claimed structure, as applied to claims 1 & 18 above, except for non-conductive layer comprises borophosphosilicate glass (BPSG). However, Hong et al teaches in Fig.1H the non-conductive layer disposed on the etch-stop layer comprises BPSG. *See also Col.3, lines 16-19.*

It is well known and conventional to form dielectric layer using BPSG in the art. It would have been obvious to one of ordinary skill in the art at the time the invention was made to substitute the SiO_2 of Chiang's device with a conventional BPSG material as taught by Hong in order to provide a dielectric layer which has a less etch rate than etch-stop layer. Furthermore, one of ordinary skill in the art would have recognized that the SiO_2 and BPSG are both considered to be art recognized functional equivalent for providing a dielectric layer and therefore an obvious expedient. Moreover, it would have been obvious to one having ordinary skill in the art the invention was made to form the dielectric layer, *having the materials as claimed*, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416.

6. Claims **11, 17, 25, 27, 32 & 39** are rejected under 35 U.S.C. 103(a) as being unpatentable over Matsuura (US 5,598,027).

Regarding claims **11, 25, 27, & 32**, Matsuura discloses a semiconductor structure comprising (Fig.1):

a conductive plug (4) positioned within an insulator layer (2); an etch-stop layer (3) deposited on said insulator and around said conductive plug; an intermediate non-conductive layer (5) provided over said etch stop layer and having at least a first and a second etched via over said plug, wherein said second etched via is above and has a greater diameter than said first etched via; and at least one conductive layer (7) in said first and second vias in electrical connection with said plug.

Although Figure 1 does not show an active region in substrate, Matsuura teaches the substrate 1 serving as an underlayer may be replaced by a circuit forming elements such as a transistor. *See Col.5, lines 22-55.*

Thus, it would have been obvious to one having ordinary skill in the art at the time the invention was made to connect the conductive plug 4 to the active region, such as source/drain region, in transistor device in order to provide an electrical connection with other elements such as power source.

Matsuura does not explicitly teach a processing unit which is coupled to a semiconductor device. It would have been obvious to one of ordinary skill in the art at the time the invention was made to have a processor unit in processor-based device, since the processor is required in the processor-based device to operate a device.

Regarding claims **17 & 39**, Matsuura disclose the claimed invention except for a plurality of memory cells. It would have been obvious to one having ordinary skill in the art at the time the invention was made to form a plurality of memory cells, since it has been held that mere duplication of the essential working parts of a device involves only routine skill in the art. *St. Regis Paper Co. v. Bemis Co.*, 193 USPQ 8.

7. Claims **13-14 & 28-29** are rejected under 35 U.S.C. 103(a) as being unpatentable over Matsuura in view of Hong (US 6,008,117).

Matsuura disclose substantially the entire claimed structure, as applied to claims 11 & 25 above, except for non-conductive layer comprises borophosphosilicate glass

(BPSG). However, Hong et al teaches in Fig.1H the non-conductive layer disposed on the etch-stop layer comprises BPSG. *See also Col.3, lines 16-19.*

It is well known and conventional to form dielectric layer using BPSG in the art. It would have been obvious to one of ordinary skill in the art at the time the invention was made to use BPSG material as taught by Hong in order to provide a dielectric layer which has a less etch rate than etch-stop layer. Furthermore, it would have been obvious to one having ordinary skill in the art the invention was made to form the dielectric layer, *having the materials as claimed*, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416.

8. Claims **12, 15-16, 26, & 30-31** are rejected under 35 U.S.C. 103(a) as being unpatentable over Matsuura in view of Chiang et al. (US 5,739,579).

Matsuura applies to claims 11 & 25 as explained above.

Matsuura does not teach the conductive layer comprising a first conductive layer in via and a second conductive layer. However, Chiang teaches in Fig.9 the conductive layer comprising a first conductive layer (barrier layer, 60) made by TiN in via and a second conductive layer (61) made by copper. Thus it would have been obvious in the art at the time the invention was made to form barrier layer between copper layer and dielectric in order to prohibit copper diffusion.

Response to Arguments

9. Applicant's arguments with respect to claims 1, 3-18, 20-32, & 39 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

10. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Donghee Kang whose telephone number is 703-305-9147. The examiner can normally be reached on Monday through Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tom Thomas can be reached on 703-308-2772. The fax phone numbers

for the organization where this application or proceeding is assigned are 703-308-7722 for regular communications and 703-308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

Steven Loke

Donghee Kang, Ph.D.
April 26, 2002